

THUNDER Logistics Modeling

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Overview

- **Definition of Logistics**
- **THUNDER Model Description**
- **THUNDER Model Version**
- **Inter- and Intra-Theater Movement**
- **THUNDER Supply Methodology**
- **Data Inputs for THUNDER Logistics**
 - **Ground Units**
 - **Air Units**
 - **Logistics facilities**



Definition of Logistics

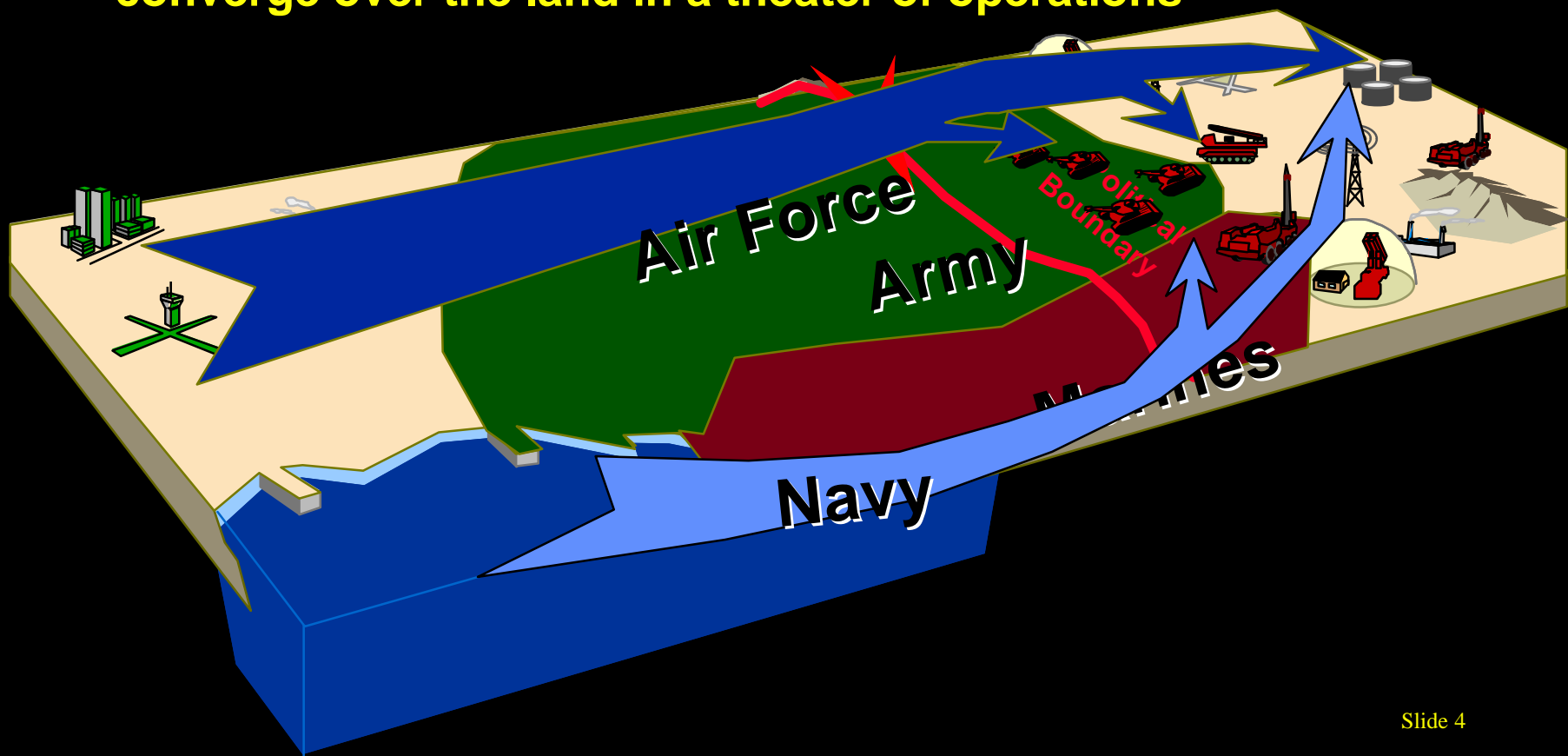
LOGISTICS: Actions, facilities, and equipment that support fielded military forces.



THUNDER

USAF's Premier Campaign Model

Foundation: Service warfighting perspectives converge over the land in a theater of operations





THUNDER--What is it?

- **Theater level model**
 - **Stochastic**
 - **Two-sided**
 - **Event based**
- **Conventional air-land warfare; limited naval warfare**
 - **“Pure” naval tasks such as ASW not modeled**
- **Written in SIMSCRIPT II.5™**
 - **Flexible language allows changes**
 - **Data-driven scenarios**



THUNDER Domain

Level of War

Strategic

Operational

Tactical



Low Intensity
Combat

Lesser Regional
Contingency

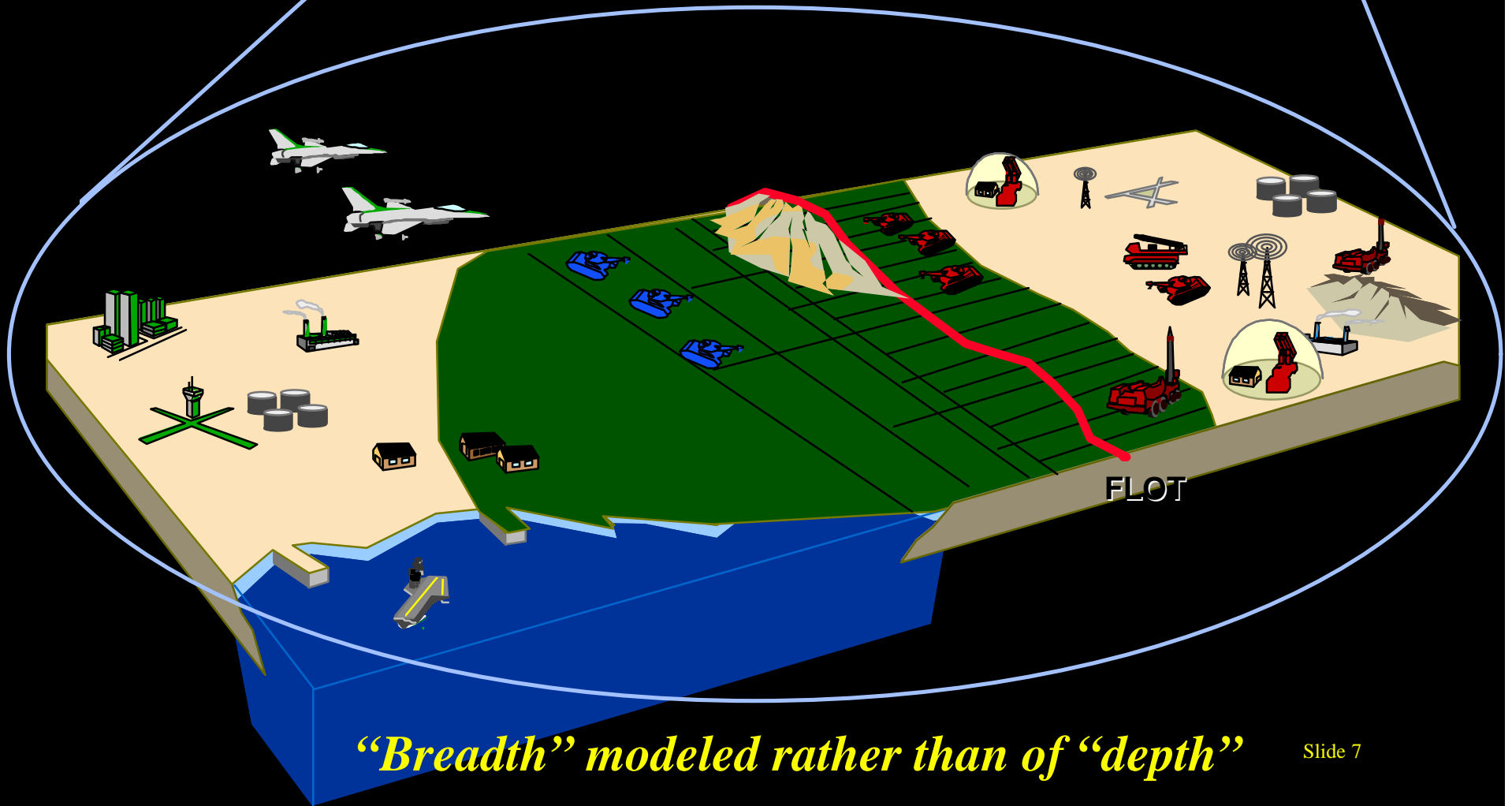
Major Regional
Contingency

Global Thermo-
Nuclear War

Spectrum of Conflict



Joint Force Commander's Perspective Modeled



“Breadth” modeled rather than of “depth”

Slide 7



THUNDER Model Version for This Presentation

- **The discussion in this presentation is based on the current version of the model--version 6.3**
- **Several enhancements of the Logistics methodology are planned for version 6.4**
 - **These will be discussed in release notes**
 - **Nothing in the basic methodology (discussed here) will change, but there will be some extra features for advanced users.**



Why Modeling Logistics?

- Answer questions about our ability to *interdict* support of enemy's forces
- Examples:
 - Where are his forces most vulnerable?
 - How best to reduce flow of supplies to front?
 - Which is better--to attack enemy directly or indirectly?
- Answer questions about our ability to *support* our forces
- Examples:
 - Is the plan logistically feasible?
 - How many bombs are used? Which kinds?
 - Do we lose sorties for maintenance? Which systems are broken most often?

All activities in THUNDER are two-sided



Inter-Theater Movement of Combat Forces

- **THUNDER** is a theater-level model
 - Does not model inter-theater lift explicitly
 - Inter-theater movement is an input, normally from mobility models or OPLANs
- Inputs required:
 - Aircraft squadrons are given a beddown base and arrival time
 - Ground units may start “offshore” and move through a SPOD, or simply given a closure time at a tactical assembly area



Intra-Theater Movement of Combat Forces

- **Aircraft squadrons can move from one base to another**
 - May be forced to dispersal by enemy advance
 - May be moved to forward bases
 - User defined percentage of support and spares moves too
- **Ground Units move on rear area network**
 - “Administrative” movement
 - Network defined by roads, railroads, sea lanes
- **Intra-theater airlift NOT explicitly modeled**



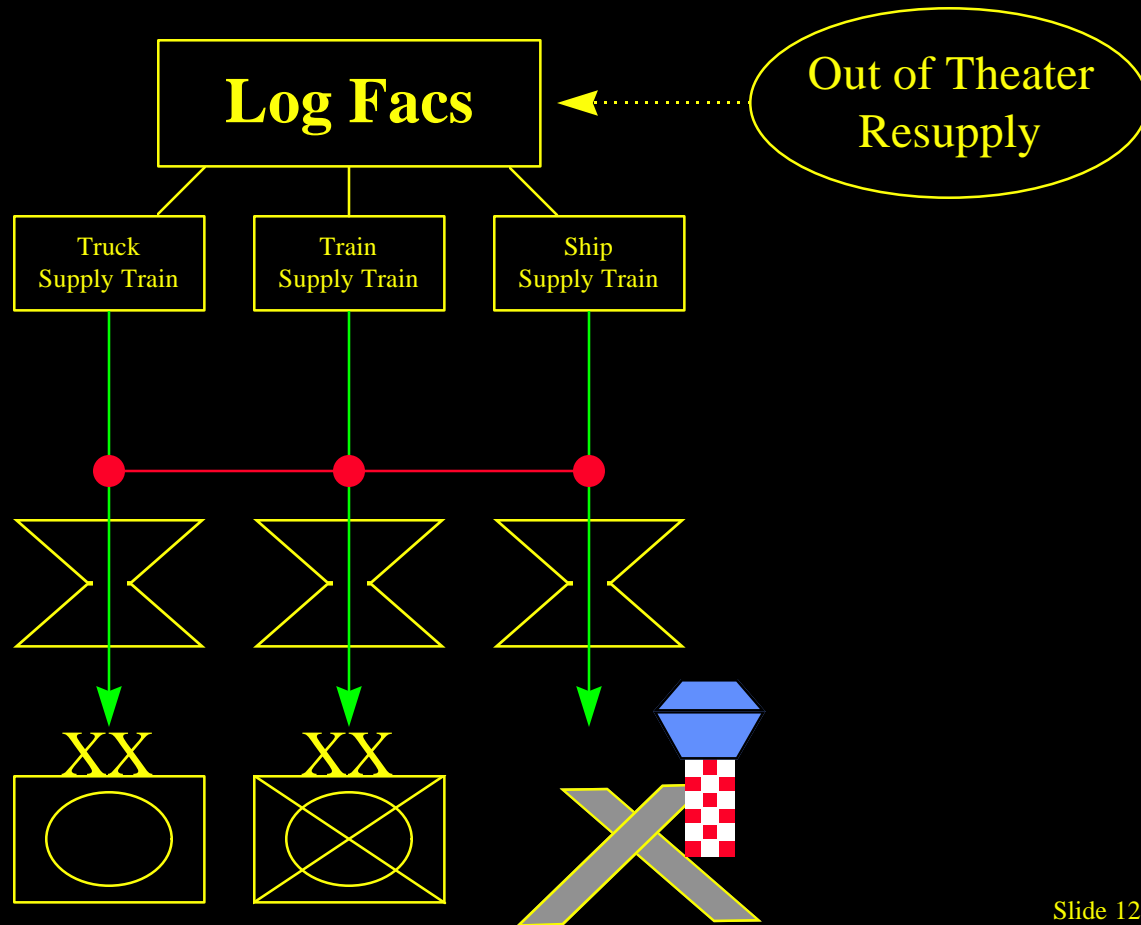
THUNDER Supply Flow

**Network Arcs
and Nodes**

**Transshipment
Points**

Chokepoints

**Units and
Airbases**





Generic THUNDER Resources

- ***Generic Resources used in THUNDER:***
 - Ammo
 - POL
 - Dry Bulk
 - Water
 - Equipment
- **Unit of measurement: STons**



Classes of Supply to THUNDER Resource Decoder

<u>Class</u>	<u>Description</u>	<u>THUNDER Class</u>
Class I	Subsistence	Water
Class II	Clothing	Dry Bulk
Class III	POL	POL
Class IV	Construction	Dry Bulk
Class V	Ammunition	Ammo
Class VI	Personal Demand Items	Dry Bulk
Class VII	Major End Items	Dry Bulk
Class VIII	Medical	Dry Bulk
Class IX	Repair Parts	Dry Bulk

Data for classes II, IV, VI-IX sums to THUNDER "Dry Bulk"



Critical THUNDER Resources

- **Certain types of resources can be defined as *Critical Resources* for detailed tracking**
 - **Ammo:**
 - **Air munitions**
 - **Surface-air munitions**
 - **Equipment**
- **Unit of measurement: Eaches**

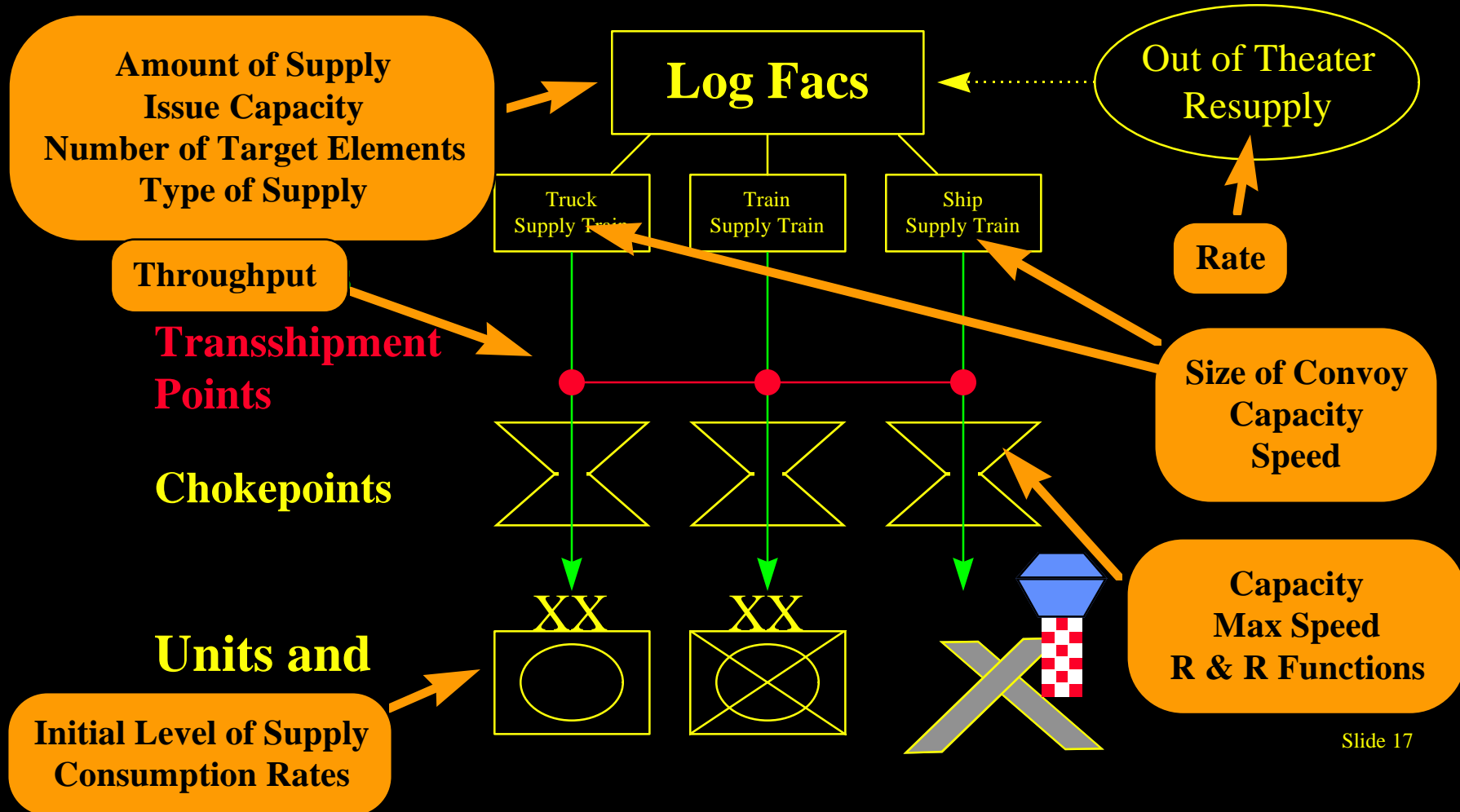


Consumers of THUNDER Resources

- **In general...**
 - **Ground units consume generic resources and surface-air munitions**
 - **Air bases consume air munitions and POL only**
 - **Air defense sites consume surface-air munitions**
- **Aircraft maintenance and repair tasks also consume maintenance resources**
- **Consumption of resources tracked by various reports**



Key Data Required in THUNDER Supply Flow





Ground Unit Consumption Data

- **Source of unit consumption data is the US Army Combined Arms Support Command (CASCOM)**
 - **Publishes planning factors for supply usage**
 - **Basis for opposing force consumption rates also**
- **Unit consumption rate of a given class of supply is:**
$$f(\text{type unit, intensity of combat, number of personnel assigned to unit})$$
- **Unit consumption defined in STons/day**



Defining Unit Initial Conditions

- **Unit DOS at start of war defined**
 - Defined globally by side
 - User defines number of days and unit status
- **As unit consumes supplies, will “re-order” more to bring back to starting supply level status**
 - Units out of supplies will not fight
- **User definable logistics cycle length--normally 24 hours**



Aircraft Service Kits

- **Aircraft service kits are the building blocks of the aircraft support methodology**
- **User defined amount of resources to support combat operations for a squadron--contains:**
 - **Repair resources (consumable and non-consumable)**
 - **Munitions**
- **Basic service kit closes with squadron**
 - **Squadron will “re-order” supplies from central pool as resources expended**
 - **Kits can be modified or supplemented**



Aircraft Maintenance Methodology

- In general...
 - To fly, aircraft need
 - to be Mission Capable (i.e. *not* broken)
 - POL
 - Munitions available for intended mission
- After sortie, aircraft may require maintenance
 - Will enter maintenance queue to be fixed
- All aircraft enter rearm and refuel queue before they can fly again



Aircraft Maintenance Resources

- **Resources and time required to perform aircraft maintenance also defined and tracked by model**
- **Two basic types of resources:**
 - **Consumables**
 - **Spare parts**
 - **Non-consumable**
 - **People, AGE, support equipment, etc**
- **Maintenance tasks to USAF 2-digit work code level tracked for certain aircraft**



Aircraft Maintenance Options

- **Two options for maintenance**
 - **Low Resolution**
 - Define probability of aircraft entering short or long term maintenance queue
 - Define fix-time for each queue
 - **High Resolution**
 - Define probability specific system failure
 - Define resources required to fix system
 - Define fix-time for system
- **Two- or Three-level maintenance possible**



Network Development

- **Rear area network for development challenging**
 - **Can find intelligence databases for information on chokepoints**
 - **Some theaters have better data than others**
 - **US Army FM 101-10-1/2 often used to define road/railroad movement rates and capacities**
- **Rear area movement of forces and supply trains automated with network search algorithms**



Logistic Facilities Definitions

- **Fixed and temporary logistics facilities defined for each side**
 - **Type supply defined: normally separate facilities for POL, Ammo, and Dry Bulk**
 - **Number of building, maximum capacity, and “on-hand” level of supply defined**
 - **Issue capacity (tons/day) defined**



Logistics Summary

- **THUNDER model gives visibility to logistics for both sides**
 - Can examine interdiction of enemy's logistics
 - Can examine support of own forces
- **THUNDER focus is theater-level**
- **Good data is key to successful use of THUNDER model**